

What is claimed is:

- 1 1. A method comprising:
2 forming a dielectric layer on a substrate;
3 forming a metal interconnect in an opening in the
4 dielectric layer; and
5 treating the dielectric layer with a solvent in a
6 sonication bath to form pores in the dielectric layer.
- 1 2. The method of claim 1 wherein forming a metal
2 interconnect in an opening in the dielectric layer
3 comprises forming a dual damascene metal interconnect.
- 1 3. The method of claim 1 wherein treating the
2 dielectric layer with a solvent in a sonication bath
3 comprises immersing the substrate in a solvent.
- 1 4. The method of claim 1 wherein forming a metal
2 interconnect in an opening in the dielectric layer
3 comprises forming smooth sidewalls on the metal
4 interconnect.
- 1 5. The method of claim 1 further comprising forming
2 a capping layer over the dielectric layer.
- 1 6. The method of claim 1 wherein treating the
2 dielectric layer with a solvent in a sonication bath

3 comprises providing sonic energy to the sonication bath in
4 a frequency range of about 10 kilohertz to about 2000
5 kilohertz.

1 7. The method of claim 1 wherein the dielectric
2 layer includes a porogen having a thermal stability greater
3 than about 400 degrees C.

1 8. The method of claim 7 wherein the porogen
2 comprises poly(vinyl alcohol).

1 9. The method of claim 7 wherein the porogen
2 comprises polycarbonate.

1 10. A method comprising:
2 forming a metal interconnect in a dielectric material
3 on a semiconductor substrate; and
4 directing an electron beam at the dielectric material
5 to form pores in the dielectric material.

1 11. The method of claim 10 wherein directing the
2 electron beam at the dielectric material comprises exposing
3 at least most of the dielectric material to an electron
4 beam flood.

1 12. The method of claim 10 wherein directing the
2 electron beam at the dielectric material comprises scanning
3 the electron beam across the dielectric material.

1 13. The method of claim 10 wherein directing an
2 electron beam at the dielectric material further comprises
3 fragmenting some of the dielectric material.

1 14. The method of claim 10 further comprising forming
2 the dielectric material on the semiconductor substrate, the
3 dielectric material having a pore-generating material
4 therein with a thermal stability greater than about 400
5 degrees C.

1 15. The method of claim 14 wherein the pore-
2 generating material comprises poly(methyl methacrylate).

1 16. A device comprising:
2 a semiconductor substrate having at least one layer
3 with conductive metal lines thereon;
4 a dielectric material between the metal lines, the
5 conductive metal lines having smooth sidewalls adjacent the
6 dielectric material.

1 17. The device of claim 16 wherein the dielectric
2 material is at least 50% porous.

1 18. The device of claim 16 wherein the dielectric
2 material is over a conductive layer.

1 19. The device of claim 16 wherein the dielectric
2 material comprises a carbon-doped oxide.

1 20. The device of claim 16 wherein the dielectric
2 material has a dielectric constant below about 3.0.

1 21. The device of claim 16 wherein the dielectric
2 material comprises fluorinated silica glass.

1 22. The device of claim 16 wherein the dielectric
2 material is a silsesquioxane-based material.

1 23. The device of claim 16 wherein the dielectric
2 material has a thermal stability greater than about 400
3 degrees C.